SODIUM CHLORATE LISTING BACKGROUND DOCUMENT FOR THE INORGANIC CHEMICAL LISTING DETERMINATION

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1. SECTOR OVERVIEW

1.1 SECTOR DEFINITION, FACILITY NAMES/LOCATIONS

There were ten sodium chlorate manufacturers in the United States in 1999. **Table 1.1** represents the names and locations of the ten sodium chlorate producers[1] and **Figure 1.1** shows their geographical distribution of the facilities presented in Table 1.1. The numbers on the map correspond to the facility numbers in Table 1.1.

Table 1.1 Sodium Chlorate Producers

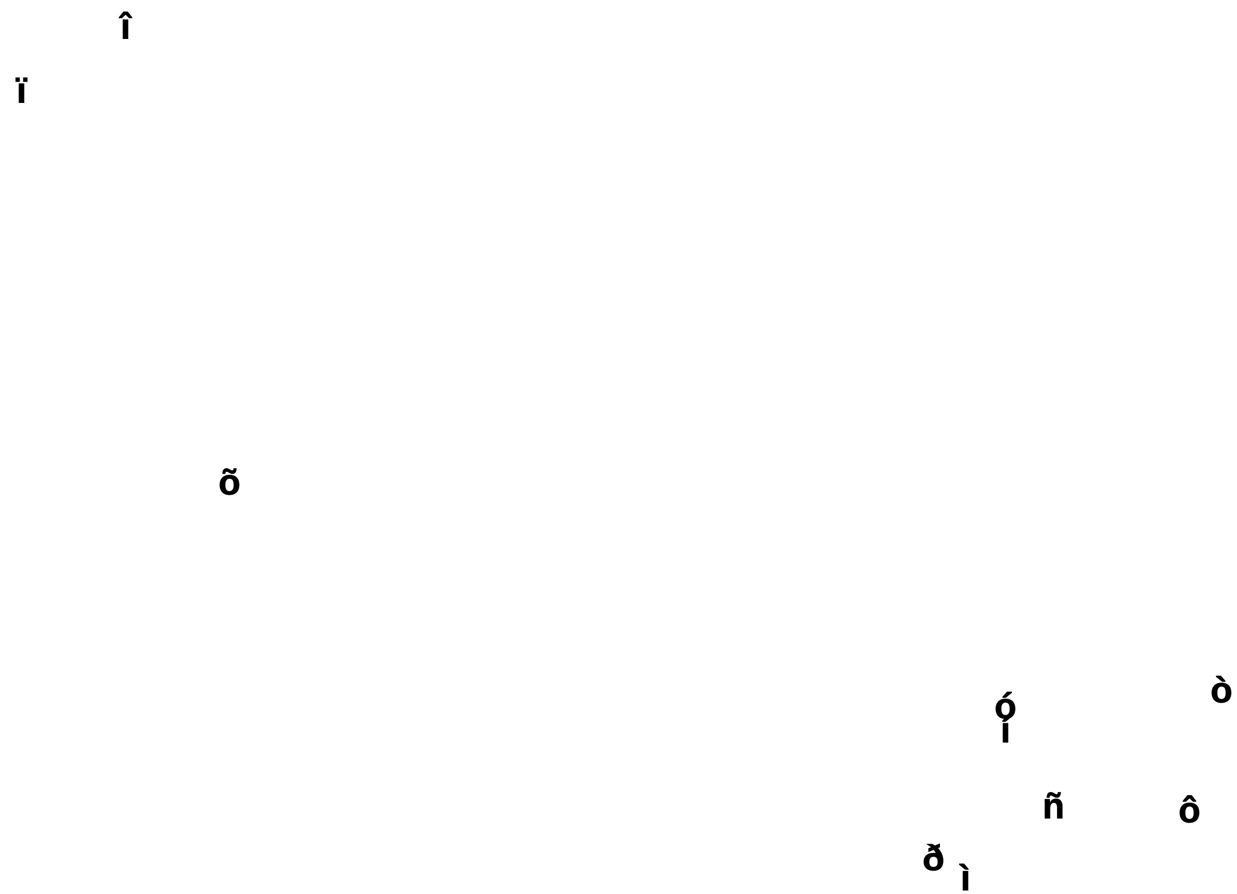
Facility Name	Facility Location
1. CXY Chemicals, USA	Hahnville, LA
2. Eka Chemicals (Eka-Columbus)	Columbus, MS
3. Eka Chemicals (Eka-Washington)	Moses Lake, WA
4. Elf Atochem North America, Inc.	Portland, OR
5. Georgia Gulf Corp.	Plaquemine, LA
6. Huron Tech-442 Corp. (Huron Tech 442)	Perdue Hill, AL
7. Huron Tech (Huron Tech-Augusta)	Augusta, GA
8. Kerr-McGee Chemical LLC	Hamilton, MS
9. Sterling Pulp Chemicals	Valdosta, GA
10.Western Electrochemical	Cedar City, UT

Elf Atochem closed its 25,000-ton Tacoma, WA plant in September 1997. Georgia-Pacific closed its 27,000-ton Brunswick, GA plant in April 1997. Huron Tech Corporation's new 90,000-ton plant in Eastover, SC came on line in March, 1999. Huron Tech 442 Corporation is scheduled for closure in mid-2000. Sterling Pulp Chemicals added 110,000 tons of capacity to its U.S. total by bringing on line Valdosta, GA plant in 1997.[2]

[1] EPA, RCRA 3007 Survey of Inorganic Chemicals Industry

[2] ChemExpo Home Page, http://www.chemexpo.com/news/profile990927.cfm

Figure 1.1 Geographical Distribution of Sodium Chlorate Producers [1]



[1] See **Table 1.1** for facility name and location.

1.2 PRODUCTS, PRODUCT USAGE AND MARKETS

Sodium chlorate, $NaClO_3$, is a cubic, colorless, odorless crystal at room temperature and has a molecular weight of 106.44 grams(g) /mol. Sodium chlorate has a melting point of 248 degrees Celsius at atmospheric pressure. It is very soluble in ethyl alcohol and degrades before its boiling point is reached.[3]

Approximately 98 percent of the sodium chlorate produced is used as the raw material for the production of chlorine dioxide. Chlorine dioxide is used as an oxidizing bleaching agent in the pulp and paper industry, replacing chlorine and sodium hypochlorite. Approximately 2 percent of the sodium chlorate produced is used as an intermediate in the production of sodium chlorite, herbicides, and uranium mining.[4]

The fast-growing demand for elemental chlorine-free (ECF) chemical pulp bleaching drives the sodium chlorate market. From 1988-1997, sodium chlorate sales have grown 8 percent per year. Near-term North American sodium chlorate demand is expected to peak at more than 2 million tons in 2001, when EPA's cluster rules, which call for ECF pulp bleaching, are fully implemented.[5] The chlorate market is expected to level off and track a modest increase in pulp demand of 2 to 3 percent per year. Current chlorate capacity is adequate. Companies have consolidated within the industry and more such moves are predicted in the future.[6]

The sodium chlorate industry's capacity continues to increase at a faster rate than demand, lowering utilization rates and putting pressure on prices and margins. Rising electrical power cost is a major concern in some regions, as electricity can constitute well over half the cost of manufacturing sodium chlorate. Currently sodium chlorate sells for $450 per ton.[7]

1.3 PRODUCTION CAPACITY

As of 1999, the current maximum production capacity of sodium chlorate in the United States is approximately 946,000 short tons per year.[8] **Table 1.2** shows the distribution of production capacity among the ten current manufacturers.

[3] ECDIN Home page, http://ecdin.etomep.net

[4] ChemExpo Home Page, http://www.chemexpo.com/news/profile990222.cfm

[5]Ibid

[6] Ibid

[7] Ibid

[8]Ibid

Table 1.2 Sodium Chlorate Production Capacity

Facility	Location	Capacity (x 10^3 short tons/yr)[9]
CXY Chemicals	Hahnville, LA	134
Eka Chemicals	Columbus, MS	219
Eka Chemicals	Moses Lake, WA	63
Elf Atochem	Portland, OR	58
Georgia Gulf	Plaquemine, LA	27
Huron Tech-442	Perdue Hill, AL	40
Huron Tech	Augusta, GA	145
Kerr-McGee	Hamilton, MS	143
Sterling Pulp	Valdosta, GA	110
Western Electrochemical	Cedar City, UT	7

Canada with 2,139,000 short tons per year has the largest production capacity in the world.[10]

[9] Ibid

[10] ChemExpo Home Page, http://www.chemexpo.com/news/profile990222.cfm

2. DESCRIPTION OF MANUFACTURING PROCESS

This industry manufactures sodium chlorate crystals and solutions from the electrolysis of a sodium chloride brine solution. All ten facilities use a similar process in producing sodium chlorate. These facilities purchase either evaporated salt or rock salt or chemical grade salt as their main feedstock in their production of sodium chlorate. Internet information searches confirm that evaporated salt, rock salt, and chemical grade salt are saleable mineral products.

2.1 PRODUCTION AND PROCESS DESCRIPTION

A generic process flow diagram for the sodium chlorate production can be found in **Figure 2.1**. The process can be divided into 6 major steps.

Brine Purification

In the first step, sodium chloride is dissolved in water. Hardness impurities such as sulfates, calcium and magnesium are removed. The sulfates are removed through the addition of calcium chloride which precipitates calcium sulfate. Sodium carbonate precipitates excess calcium from the solution as calcium carbonate and sodium hydroxide precipitates the magnesium as magnesium hydroxide. Facilities remove these impurities from the brine solution by filtration, the addition of filter aid, passing the brine solution through a filter press or allowing the impurities to settle to the bottom of a tank where liquids slowly seep from the waste. One facility removes the impurities with a water sluice sending the material to a waste treatment system.

Electrolysis

In the second step, the purified brine solution is fed into electrolytic cells and sodium dichromate is added to the process stream. The sodium dichromate is added to inhibit corrosion and to promote the main reaction in the electrolytic cell. The types of electrodes used in the electrolytic cell can vary. Four facilities use dimensionally stable electrodes (DSA) in the electrolytic cells. These cells have anodes composed of a titanium base coated with ruthenium dioxide or platinum metal and cathodes made of carbon steel. Other facilities use steel electrodes or copper cathodes with lead plated graphite anodes.

Hydrogen and sodium hydroxide are formed at the cathode while chlorine gas is discharged at the anode. The chlorine undergoes hydrolysis to form hypochlorous acid, HClO, which then undergoes autoxidation to produce the chlorate ion, ClO_3^-.

The reaction steps are:

a) $Cl_2 + H_2O \div HClO + H^+ + Cl^-$
b) $2\ HClO + ClO^- \div ClO_3^- + 2Cl^- + 2\ H^+$

Solids accumulate in the bottom of the electrolytic cells as sludge. The solids are the result of the deterioration of the steel cathodes as well as other insoluble impurities. The sludge is removed from the cells periodically during scheduled maintenance. This is the predominant source of process sludges generated from the production of sodium chlorate where chromium or lead is present. There are other processes that generate this wastestream that are peculiar to a particular facility. At Georgia Gulf, Plaquemine, LA, a side stream is removed from the sodium chlorate solution after it has passed through the electrolysis process. This side stream is filtered producing a sludge that contains sulfate and carbonate solids contaminated with chromium. This is a portion of the process sludges generated from the production of sodium chlorate where chromium or lead is present. Some facilities periodically remove the electrolytic cells from service, replace the anode/cathode arrangement, and wash them with water generating a filter cake that is contaminated with chromium.

Dehypo Treatment

The third step of the process removes residual hypochlorite from the mother liquor. This is accomplished by heating the electrolytic solution, adding urea, formate or hydrogen peroxide. This step is done to protect downstream equipment which is made of stainless steel and is susceptible to hypochlorite corrosion. The sludges and filters produced from this step are part of two wastestreams, process sludges generated from the production of sodium chlorate where chromium or lead is present and spent filters generated from the production of sodium chlorate where chromium or lead is present. At one facility the sodium hypochlorite, $NaClO$, is removed from the sodium chlorate solution as it leaves the electrolytic cell and the solution is split between two processes, sodium chlorate crystallization and Dechrome production. The sodium chlorate solution that goes to the Dechrome process is filtered a second time serving as an additional source of process sludges generated from the production of sodium chlorate where chromium or lead is present and spent filters generated from the production of sodium chlorate where chromium or lead is present.

Crystallization, Salt Recovery, and Drying

The fourth step in the process, crystallization, salt recovery, and drying, concentrates the liquor by evaporation, recycles residual brine back to the process, dries the crystals and produces the sodium chlorate product. Steam is used to form a vacuum during this step and enough water is removed from the solution to cause the precipitation of crystalline sodium chlorate. The chlorate is separated from the mother liquor and sent to the drying process. Wastestreams generated from this step include spent filters without chromium or lead, and wastewaters recycled back to the process.

Chromium Removal

In the fifth step hexavalent chromium is reduced to trivalent chromium and precipitated using sodium sulfide or sodium thiosulfate. Most facilities recycle the process wastewaters that contain chromium back into the process. Some facilities recycle the wastewater that contains chromium back to the electrolytic cells and some facilities recycle the wastewaters with chromium back to the brine solution. One facility reduces hexavalent chromium to chromium (III) oxide using ferrous iron and sends the wastewater to a treatment unit where it is mixed with wastewater from the onsite titanium dioxide processes and moved to surface impoundments.

Hydrogen Purification

The sixth step in the process, hydrogen purification and recovery usually occurs concurrently with the electrolysis step in the process. Hydrogen gas is produced at the cathodes of the electrolytic cells. The hydrogen gas is purified by removing excess chlorine gas from the gaseous stream using sodium thiosulfate and caustic scrubbers or passing the gaseous stream through carbon filter beds. The purified hydrogen gas is burned in boilers for steam, or vented to the atmosphere.

At one facility the purified hydrogen gas stream is compressed and delivered to a neighboring facility for use as an energy source in boilers.

2.2 PRODUCTION TRENDS, CHANGES AND IMPROVEMENTS

One facility, Huron Tech - 442 Corp, Perdue Hill, AL, will close in the midyear of 2000. There is no other indication of upcoming production changes from current practices.

Figure 2.1 Generic Process Flow Diagram for the Production of Sodium Chlorate

3. WASTE GENERATION AND MANAGEMENT

This section discusses all the wastes and materials generated from the production of sodium chlorate. **Section 3.1** discusses the contaminated water and debris reported in one facility's RCRA §3007 questionnaire that are outside the scope of the Consent Decree. **Section 3.2** describes the materials that are either piped directly back to the sodium chlorate production process or used for other purposes. **Section 3.3** details six categories of wastes generated from the sodium chlorate production process, including waste characterization, waste management practices, facilities/wastes selected for record sampling, and results of initial risk screening analyses. **Appendix A** tabulates the wastestreams, volumes of the wastestreams (in MT/yr), and the reported management practices for each of the six waste categories.

3.1 CONTAMINATED WATER AND DEBRIS

One facility reported one-time generation of contaminated water and debris from demolition of an old, abandoned contaminated water tank. The contaminated water was deep welled and the debris was disposed off-site in a Subtitle C landfill. EPA considers these materials not wastes from the "production" of sodium chlorate and, therefore, outside the scope of the Consent Decree.

3.2 MATERIALS

During the production of sodium chlorate, all ten facilities produce materials that are either piped directly back to the production process or used for other purposes. These materials are described in **Sections 3.2.1** and **3.2.2**. **Table 3.1** summarizes the materials generated by the facilities from the production of sodium chlorate.

3.2.1 In-process Recycling

Scrubber waters and filtrates are piped to onsite sodium chlorate production units for use. Because these materials are managed prior to reuse in ways that present low potential for releases to the environment, and because we evaluated process wastes generated after they are reused, we do not believe that these secondary materials present significant threats.

3.2.2 Materials Used or Reused for Other Purposes

At all ten facilities, hydrogen gas is produced by the electrolysis units and is either piped to on-site boilers, vented, or in one case, piped to a compression plant where it is compressed and sold. Because the material is a gas produced from a production unit rather than a waste management unit and is conveyed to its destination via piping, the gas is not a solid waste. RCRA Section 1004(27) excludes non-contained gases from the definition of solid waste and thus they cannot be considered a hazardous waste. (See 54 FR 40973). Because these materials are not solid wastes when produced, we did not evaluate them further.

Eka Chemicals-Columbus reports generating a sulfate solution from brine treatment. The wastewater is transported to an off-site facility and used in their black liquor pulping process. The sulfate solution is added to black liquor for use in a wood digester. Any re-use of black liquor is excluded from RCRA regulation (40 CFR 261.4(a)(6)). The black liquor is burned to recover sulfur values for reuse in pulping. EPA considers any wastes associated with the black liquor process to be beyond the scope of the consent decree and did not evaluate them further. The black liquor is burned to recover sulfur values for reuse in pulping. The sulfate solution is stored in tanks prior to use in the pulping process and burning of the black liquor is subject to MACT standards, therefore, there are no exposure pathways of concern.

Table 3.1 Materials Generated from the Production of Sodium Chlorate

Facility	In-Process Recycling	Materials Used or Reused	
	Scrubber Waters and Filtrates Recycled Back to the Process	Hydrogen Gas	Wastewaters
CXY Chemicals	x	x	
Eka-Columbus, MS	x	x	x
Eka-Moses Lake, WA	x	x	
Elf Atochem	x	x	
Georgia Gulf	x	x	
Huron Tech-Augusta, GA	x	x	
Huron Tech-442	x	x	
Kerr-McGee	x	x	
Sterling Pulp	x	x	
Western Electrochemical	x	x	

3.3 WASTES PRODUCED BY THE SODIUM CHLORATE PRODUCTION PROCESS

Wastes generated from the production of sodium chlorate consists of process sludges, spent filters, and wastewaters. Since all ten facilities are using saleable mineral products as their only feedstock, their processes may not be classified as mineral processing, rather they are conducting chemical manufacturing. Therefore, all wastes from the production of sodium chlorate are non-Bevill exempt solid waste.

Based on an evaluation of survey responses from the ten sodium chlorate producers, we divided the wastes further into six general waste categories based on the presence or absence of chromium or lead. The sodium chlorate industry in general characterizes wastes that have been in contact with chromium or lead as hazardous (D007 or D008). Chromium is introduced into the process by the addition of sodium dichromate into electrolytic cells to protect electrodes from corrosion and to improve product yields. The presence of lead in the wastes results from the deterioration of anodes that can be used in the electrolytic cells. The six waste categories are:

- Process sludges with chromium or lead. These include electrolytic cell sludge, product filter press sludge, and those brine treatment sludges generated from purification where brine is formed by mixing salts with chromium-laden wastewaters recycled from various steps in the process.

- Process sludges without chromium and lead. These wastes include filter press sludge or drum sludge from treatment of brine, when recycled chromium-laden wastewater is not used in the brine dissolution step.

- Spent filters with chromium or lead. The filters are generated at several points in the production process, but most are generated after the electrolysis of the brine solution when the mother liquor is filtered to remove impurities.

- Spent filters without chromium and lead. Examples include disposable cartridge and sock filters from treatment of brine, when recycled chromium-laden wastewater is not used in the brine dissolution step.

- Wastewaters with chromium that are not recycled back to the process.

- Other wastewaters that do not contain chromium or lead and are not recycled (condensate, cooling water, and ion-exchange wastewater).

Table 3.2 presents a summary of wastes generated by each of the ten facilities from production of sodium chlorate.

Table 3.2 Wastes Generated from the Production of Sodium Chlorate

Facility	Process Sludge with Chromium or Lead	Process Sludge without Chromium and Lead	Spent Filters with Chromium or Lead	Spent Filters without Chromium and Lead	Wastewater with Chromium Not Recycled Back to Process	Other Wastewaters Without Chromium or Lead That Are Not Recycled
CXY	x		x			x
Eka-Columbus, MS	x	x			x	x
Eka-Moses Lake, WA	x	x	x	x		
Elf Atochem	x	x				x
Georgia Gulf	x	x	x			x
Huron Tech Augusta	x	x	x	x		
Huron Tech 442	x		x	x		
Kerr-McGee	x		x		x	
Sterling Pulp	x			x		
Western Electrochemical	x		x			

x-facility generates this waste

3.3.1 Record Sampling and Analysis

Based on an evaluation of survey responses from the ten sodium chlorate production facilities, similar types of wastes from multiple facilities were grouped into six general categories for further listing determination.

Three facilities were selected for record sampling: Kerr-McGee-Hamilton, MS; Eka Chemicals-Columbus, MS; and Huron Tech-Augusta, GA. These facilities and wastes were selected because, based on the survey information collected, we believe that the wastes generated by these three facilities are fully representative of the wastes generated by this industry and their management practices. **Table 3.3** presents the record samples and the information used for record sampling decision, including waste codes, waste volumes, and current waste management practices. Record samples collected for each of the six waste categories are discussed further in later sections of this background document.

As described in the facility-specific SAPs and the QAPjP, the record samples collected were analyzed for the following:

- Total, TCLP, and SPLP concentrations of metals
- Total, TCLP, and SPLP concentrations of hexavalent chromium
- pH
- Oxidation-reduction potential
- Specific gravity
- Percent solids

Appendix B contains a summary of the record sample results. The complete analytical data reports are available in the docket, including QA/QC and data validation information.

Table 3.3 Summary of Sodium Chlorate Production Wastes and Record Sample Collection

Waste Categories (# of facilities)	# of Streams	Waste Codes	Volume (MT/yr)	Management Practices	Record Sample ID
Process sludges with chromium or lead (10)	19	D001 D002 D007 D008	28,547	Nine facilities store the waste on site in containers and then send it to Subtitle C landfills or incinerators; one facility decharacterizes the waste in tanks before managing it in on-site surface impoundments.	EC-SC-01 HT-SC-01 HT-SC-02 KM-SC-01 KM-SI-01 KM-SI-04
Process sludges without chromium and lead (5)	7	none reported	1,886	Three facilities store the waste on site in containers and then send it off site to municipal Subtitle D landfills; one facility stores the waste on a concrete pad with secondary containment before applying it to an onsite land farm; one facility stores the waste on site in containers and then sends it off site to an industrial Subtitle D landfill; one facility stores the waste on site in containers before sending it off site for recycling.	EC-SN-01 EC-SN-02 EC-SN-03 HT-SN-01
Spent filters with chromium or lead (7)	12	D001 D007 D008	82.9	All seven facilities classify the waste as hazardous; six send the waste to Subtitle C landfills or incinerators; one facility decharacterizes the waste on site in tanks, stores it in a closed compactor, then ships the waste off site to an industrial Subtitle D landfill.	KM-FB-01
Spent filters without chromium and lead (4)	6	none reported	3.52	Three facilities store the waste on site in containers and send it off site to Subtitle D landfills. One facility stores the waste with process sludge in onsite containers and then sends it off site to a Subtitle C facility for stabilization prior to disposal in a Subtitle C landfill.	HT-FB-01 HT-FB-02
Wastewaters with chromium that are not recycled back to the process (2)	5	D002 D007	26,736	One facility sends the wastewater to an offsite Subtitle C facility for treatment and disposal. One facility combines and treats the wastewater with other process wastewaters in tanks prior to discharge to onsite surface impoundments.	KM-SC-01 KM-SI-01 KM-SI-04

Waste Categories (# of facilities)	# of Streams	Waste Codes	Volume (MT/yr)	Management Practices	Record Sample ID
Other wastewaters that do not contain chromium or lead and are not recycled (4)	4	none reported	10,744	Discharged via NPDES permit or to a POTW	Not Sampled

3.3.2 Process Sludge with Chromium or Lead

Waste Generation

All ten facilities generate this residual category. The predominant source of process sludge with chromium or lead is from the periodic cleanout of electrolytic cells used to convert the brine solution to sodium chlorate. Other sources are sludges generated from the purification of brine where brine solution is mixed with chromium-laden wastewaters recycled from various steps in the process and from sludges formed when the product is filtered.

The "process sludge with chromium" is generated at various rates from less than 1 metric ton (MT)/yr to 11,000 MT/yr. Appendix A, Table 1 lists wastestreams of this waste category, including the waste generators, RINs, RCRA waste codes, waste volumes, final waste management step, and record sample numbers.

Waste Management

Process sludge with chromium or lead is managed in off-site Subtitle C landfills or incinerators, or decharacterized in tanks before managing in on-site surface impoundments. **Table 3.4** presents the volume and final management step used by the facilities for this waste. Some facilities contribute more than one residual to this waste.

Table 3.4 Waste Management Summary for Process Sludge with Chromium or Lead

Final Management	Total Volume (MT/yr)
Off-site Subtitle C landfill	1,682
Off-site incineration	65
Discharge to on-site wastewater treatment facility	26,800

Waste Characterization

Two sources of residual characterization were developed during the industry study:

- RCRA § 3007 questionnaire

  Eight generators report this wastestream to be characteristically hazardous for D007 (chromium), and or other characteristic (D001 (ignitability), D002 (corrosivity), or D008 (lead)). Two facilities do not classify their wastes as characteristic but nevertheless send their wastes to Subtitle C landfills.

Facilities report that this waste has a pH in the range of 6 - 12, and the primary chemical constituent in the waste is chromium or lead.

- Six record samples collected from three facilities and analyzed by EPA.

Six samples were collected for our assessment of this waste. **Table 3.5** shows the process sludge with chromium or lead samples collected and their corresponding sample numbers.

Table 3.5 Record Samples, Process Sludge with Chromium or Lead

Facility	Sample No.
Eka Chemicals Incorporated, Columbus, MS	EC-SC-01
Huron Tech, Augusta, GA	HT-SC-01 HT-SC-02
Kerr-McGee, Hamilton, MS	KM-SC-01 KM-SI-01 KM-SI-04

Results of Initial Risk Screening Analysis

Three samples (EC-SC-01, HT-SC-01, HT-SC-02) were collected at two facilities (Eka Chemical-Columbus, MS; Huron Tech- Augusta, GA) to characterize wastes destined for Subtitle C treatment and disposal. EC-SC-01 is the filter press waste produced when a part of the sodium chlorate solution leaving the electrolytic cell is filtered to remove impurities. HT-SC-01 is sludge that accumulates at the bottom of the electrolytic cell, and HT-SC-02 is sludge that accumulates on a process filter after the sodium chlorate solution leaves the electrolytic cell and has been treated with urea and filtered. Complete analytical results of these samples, cited in Appendix B, are part of the record characterizing this waste category, but were not used for risk assessment because the Subtitle C disposal scenario was not identified for modeling.

Another three samples were collected from the Kerr McGee-Hamilton, MS facility that classifies this waste as characteristically hazardous and treats it in tanks to reduce hexavalent chromium to the relatively stable trivalent state. The facility commingles this sludge with wastes from the production of titanium dioxide (TiO_2) in these tanks. The treated mixture is subsequently managed in on-site surface impoundments. One sample (KM-SC-01) reflects the untreated sodium chlorate sludge collected from a dedicated sump prior to commingling with the titanium dioxide wastewaters. The second sample (KM-SI-01) is the treated combined wastes collected at the inlet to the surface impoundments. The third sample (KM-SI-04) is the treated commingled sludge collected from one of the on-site surface impoundments.

Table 3.6 presents the analytical results for the three Kerr McGee samples. The HBL for each constituent is provided for comparison. For the untreated waste, only totals were conducted because the sample was collected from the dedicated sump (prior to treatment, commingling with titanium dioxide wastes and land placement). The only constituent of concern in the untreated sodium chlorate waste was hexavalent chromium. As shown in **Table 3.6**, all other constituents in the untreated wastes were present at levels below their respective HBLs. For the treated waste, totals plus leaching with TCLP and SPLP tests are reported. Analytical data shows that total hexavalent chromium level in the treated sample (KM-SI-01) is quite low (below the HBL for hexavalent chromium). Note that while hexavalent chromium doe not exceed the HBL, other constituents of concern are present in this sample at elevated levels; these constituents of concern are associated with the commingled titanium dioxide wastes and were assessed as part of that sector's listing determination elsewhere in today's record.

We also assessed the leachable levels of chromium from sludge in the impoundment, even though this sludge is largely composed of solids from titanium dioxide production. The leachable chromium in this sample (KM-SI-04), both total and hexavalent chromium, is below the HBLs, again demonstrating the effectiveness of the treatment methodology. No other toxicants in the untreated wastewater sample (KM-SC-01) exceed the health-based levels used for the screening analysis.

Table 3.6 Waste Characterization for Process Sludge with Chromium or Lead

Analytical Data							
	KM-SC-01 (Untreated)	**KM-SI-01** (Treated)			**KM-SI-04** (Sludge)		HBL (mg/l)
Parameter	Total	Total	TCLP	SPLP	TCLP	SPLP	
Arsenic	<0.005	0.04	<0.5	<0.05	<0.5	<0.05	0.0007
Barium	0.11	1.8	<2	0.26 B	<2	0.09	1.1
Cadmium	<0.005	0.024	<0.05	<0.05	<0.05	<0.05	0.0078
Chromium	0.99	31.1	<0.5	<0.05	1.3	<0.05	23
Chromium^{+6}	0.85 L	<0.02	N/A[11]	<0.02	0.03	<0.02	0.05
Iron	12.5	1,120	<1	<0.5	<1	<0.5	5
Lead	0.007	0.38	<0.5	<0.03	<0.5	<0.03	0.015
Manganese	0.30	25.9	0.7	0.7	59.9	<0.05	0.73

[11] TCLP analyses were not run for Cr+6 using TCLP leachant because of typically low or no recovery of hexavalent chromium due to conversion of hexavalent chromium to trivalent chromium.

Analytical Data							
	KM-SC-01 (Untreated)	**KM-SI-01** (Treated)			**KM-SI-04** (Sludge)		HBL (mg/l)
Parameter	Total	Total	TCLP	SPLP	TCLP	SPLP	
Molybdenum	<0.005	0.53	<0.2	0.3	<0.2	0.27	0.078
Nickel	<0.005	1.97	<0.2	<0.05	3.7	<0.05	0.31
Thallium	<0.005	0.086	<2	<0.05	<2	<0.05	0.0013
Vanadium	<0.005	59.6	<0.05	<0.05	<0.05	0.08	0.14
pH	10.1 E	8.4 E	NR		4.96	10.0	
Percent solids	<2%	3.4	NA				
Oxidation red. pot. mV	434	329,000					

NA: Not Analyzed
NR: Not Reported
B: Analyte also detected in the associated method blank analysis.
L: Concentration reported from analysis performed outside required holding time. Value should be considered biased low.
Chromium total concentration in the treated waste is higher than the untreated waste due to commingling with other wastes from the titanium dioxide production process.

Based on the record sampling data, it appears that the only constituent of concern associated with the sodium chlorate process, hexavalent chromium, has been treated so that leachable hexavalent chromium levels are below health-based levels. The treated, co-mingled waste sample collected at the influent to the surface impoundment, had undetected level of hexavalent chromium (<0.02 mg/L in the total and SPLP analyses).

The treated effluent is managed in a series of four surface impoundments, three of which are lined with leachate collection systems. The wastewaters from the sodium chlorate process only comprise about 2 percent of the wastewaters going to Kerr McGee's treated tanks. Therefore, our assessment of the impoundment sludge (KM-SI-04) and constituents other than chromium present in the commingled wastewater (KM-SI-01) at elevated levels are covered in the titanium dioxide assessment. For a more complete description of this sludge analysis, see the Titanium Dioxide Listing Background Document and Risk Assessment Listing Background Document in the docket for this proposed rulemaking.

3.3.3 Process Sludge without Chromium and Lead

Waste Generation

Five facilities generate this residual. This sludge is produced as part of the initial purification of the brine solution. These wastes include filter press sludge or drum sludge from the treatment of brine, when recycled chromium-laden wastewater is not used in the brine dissolution step. Process sludge without chromium is generated at various rates from 37 MT/yr to 790 MT/yr. Appendix A, Table 2 lists wastestreams of this waste category, including the waste generators, RINs, RCRA waste codes, waste volumes, final waste management step, and record sample numbers.

Waste Management

Four facilities manage the waste as non-hazardous in an on-site land farm, offsite municipal and industrial Subtitle D landfills. Eka Chemicals, Columbus, MS, ships their waste offsite for recycling. **Table 3.7** presents the volume and final management step used by the facilities for this waste.

Table 3.7 Waste Management Summary for Process Sludge without Chromium and Lead

Final Management	Total Volume (MT/yr)
Permitted solid waste landfarm	37
Off-site municipal Subtitle D landfill	224
Off-site industrial Subtitle D landfill	835.2
Recycling	790

Waste Characterization

Two sources of residual characterization were developed during the industry study:

- RCRA § 3007 questionnaire
- Four record samples collected from two facilities and analyzed by EPA.

Five facilities classified this wastestream as non-hazardous. Facilities reported the following physical and chemical characteristics for this wastestream in the RCRA § 3007 questionnaire:

- This waste has a pH in the range of 10 to 11 and a moisture content below 50 percent.
- Chemical constituents reported were: barium, cadmium, lead, calcium carbonate and magnesium hydroxide.

Four samples of this waste category were collected from two facilities. EC-SN-02 and HT-SN-01 were generated in the sodium chlorate process from the initial treatment of the rock salt with sodium carbonate and sodium hydroxide to precipitate and remove calcium carbonate and magnesium hydroxide. The filter cakes were collected from a roll-off bin and a hopper. EC-SN-01 was generated by filtering a brine solution to remove the sulfate impurities. The sample was collected from a roll-off bin. EC-SN-03 is generated at the bottom of a brine tank where the sulfate impurities precipitate from the initial brine solution. This sample was collected from a basin in which it is stored. **Table 3.8** shows the "process sludge without chromium and lead" samples collected and their corresponding sample numbers.

Table 3.8 Record Samples, Process Sludge without Chromium or Lead

Facility	Sample No.
Eka Chemicals Incorporated, Columbus, MS	EC-SN-01 EC-SN-02 EC-SN-03
Huron Tech, Augusta, GA	HT-SN-01

Two of the four samples (HT-SN-01 and EC-SN-03) are representative of wastes that are land disposed. The other two samples (EC-SN-01 and EC-SN-02) are representative of wastes that are generally recycled and occasionally also landfilled.

Results of Initial Risk Screening Analysis

Table 3.9 identifies the constituents of concern that we found to be present in the waste at levels exceeding their respective HBLs and/or soil screening levels.

Table 3.9 Analytical Results for Process Sludge Without Chromium and Lead

Parameter	HT-SN-01			EC-SN-03			EC-SN-01			EC-SN-02			HBL (mg/L)	SSL[1] (mg/kg)
	Total (mg/kg)	TCLP (mg/L)	SPLP (mg/L)	Total (mg/kg)	TCLP (mg/L)	SPLP (mg/L)	Total (mg/kg)	TCLP (mg/L)	SPLP (mg/L)	Total (mg/kg)	TCLP (mg/L)	SPLP (mg/L)		
Arsenic	14.3	0.03	<0.05	<5	<0.005	<0.05	<5	<0.005	<0.05	<5	<0.005	<0.05	0.0007	5.2
Cadmium	27.4	<0.05	<0.05	<5	<0.05	<0.05	<5	<0.05	<0.05	<5	<0.05	<0.05	0.0078	4.3
Chromium	57.3	<0.05	<0.05	15.3	<0.05	<0.05	<5	<0.05	<0.05	10.1	<0.05	<0.05	23	37
Copper	17.2	<0.25	<0.05	15.3	<0.05	<0.05	<5	<0.25	<0.05	5.3	<0.25	<0.05	1.3	17
Lead	14.8	0.024	<0.03	139	<0.03	<0.03	19.3	0.12 E	0.001	34.9	0.05 E	0.002 E	0.015	400*
Manganese	69.2	0.08	<0.05	238	4.5	<0.05	125	0.5	<0.05	51.9	0.7	<0.05	0.73	330
Mercury	0.5 L	<0.002	<0.0002	<0.1	<0.002	<0.0002	<0.1	<0.002	<0.0002	<0.1	<0.002	<0.0002	0.0047	24*
Nickel	7.4	<0.2	<0.05	12.1	0.4	<0.05	<5	<0.2	<0.05	<5	<0.2	<0.05	0.31	13
Silver	1.1	<0.1	<0.01	<1	<0.1	<0.01	<1	<0.1	<0.01	<1	<0.1	<0.01	0.078	400*
Zinc	111	<2	<0.5	279	10.6	<0.5	<50	<2	<0.5	<50	<2	<0.5	4.7	48

[1] SSL: Soil Screening Level based on geometric mean background concentration (mg/kg) in soils in conterminous U.S. Or soil ingestion HBL (marked *).

E: Analysis performed outside recommended holding time. Reported value should be considered as estimated.

The Agency evaluated wastes managed under the four reported management scenarios: on-site land farm, municipal Subtitle D landfill, industrial Subtitle D landfill, and recycling. All scenarios screen out (as described further below), with the exception of the municipal D landfill scenario.

Land Treatment Scenario

Georgia Gulf reports managing 37 MT/yr in their land treatment unit. While EPA did not sample at Georgia Gulf, we determined that the available samples (HT-SN-01, EC-SN-03, EC-SN-01, and EC-SN-02) are representative of Georgia Gulf's wastes because Georgia Gulf's process is similar to Huron Tech's. (Georgia Gulf uses mined salt from a salt dome in LA, not rock salts as three other facilities do. We did not however find any information that links raw materials to variations in waste composition for this sector.)

EPA previously assessed the same on-site land farm as part of the chlorinated aliphatics listing determinations (see proposed rule at 64 FR 46475, August 25, 1999). Our assessment of sodium chlorate waste placed in the same unit was based on our earlier modeling of this unit for a waste from the production of chlorinated aliphatics (EDC/VCM sludges).

In assessing this management scenario, we first compared the total constituent concentrations of all four record samples to background soil concentrations. All of the metals screen out against background soil concentrations except for arsenic, cadmium, chromium, copper, lead, mercury, silver, and zinc as indicated in **Table 3.9**. We then used the metal modeling results generated from the chlorinated aliphatics listing determination to calculate the proportional sodium chlorate risks. The proportional sodium chlorate risks were calculated, as shown below:

$$\text{NaClO3 risk} = (\text{CA risk}) \times \frac{\text{NaClO3 conc.}}{\text{CA conc.}} \times \frac{\text{NaClO3 volume}}{\text{CA volume}}$$

As shown in **Table 3.10**, the calculated modeling results of arsenic, cadmium, hexavalent chromium, and zinc for the same land farm are all below a hazard quotient (HQ) of 1 and 10^{-6} risk thresholds for the land treatment scenario. **Table 3.11** presents a characterization of the land farm unit as reported by the facility in their §3007 survey.

Table 3.10 Modeling Results for Process Sludge without Chromium and Lead That is Managed Under the Land Treatment Scenario							
Parameter	Concentration	Waste volume	Non-cancer risk (HQ)	Cancer risk (groundwater)	Ingestion risk (HQ)	Cancer risk (ingestion)	Cancer risk (inhalation)
EDC/VCM WWT sludge							
Chromium +6	287 mg/kg	624 MT/yr	0.5		0.06		2x10-6
Cadmium	1.65		0.1		0.002		4x10-11
Zinc	1,810		0.2		0.001		
Arsenic	27			1x10-5		6x10-6	
Sodium chlorate sludges w/o chromium							
Chromium +6	57.3	37.0 MT/yr	0.0012		0.00071		3.0x10-8
Cadmium	27.4		0.098		0.002		3.9x10-11
Zinc	279		0.0018		0.000009		
Arsenic	14.3			3.1x10-7		1.9x10-7	

Finally, we compared the total concentrations of copper, lead, mercury, and silver of all samples to the soil ingestion HBL because these constituents were not assessed in the chlorinated aliphatics risk analyses. The maximum total concentrations of lead, mercury, and silver are well below the soil ingestion HBL, and the maximum total concentration of copper in this waste (i.e., 17.2 mg/kg) is very close to the soil ingestion HBL (i.e., 17 mg/kg). We believe that after mixing with soil in the land application unit, the copper concentration in the unit will be even lower. We do not believe this waste poses risk via volatilization to the air pathway because it does not contain any toxic volatile chemicals. In addition, the comparison described above for this unit, where we determined that the detected waste constituents are present in the waste at levels below or very close to the soil ingestion levels, demonstrates that any wind blown dust from the unit should not pose risk at levels of concern. Therefore, the land treatment scenario for this type of waste screens out.

Table 3.11 Georgia Gulf's On-Site Land Treatment Unit Characterization

Unit Name and RMUN	Land Farm, RMUN 1
Total acreage	170 acres
Acreage in use	140 acres
Depth of incorporation	6 inches
Liner Code	no liner
Active life	138 years. (The permit indicates that the remaining useful life is ~ 40 years)
Permits	standard solid waste permit granted by the state of LA DEQ
Leachate collection	none
Nearest downgradient water body	8,000 ft
Soil type	Landfarm isometric profile is available. The soil at the site is represented as a thermic vertic Haplaquepts, a clayey soil in a warm climate, contains 40.6 to 87.5% clay. CEC=30-40 meq/100g soil. OM=0.02 to 2.39%.
Monitoring conditions	Test of the waste/soil mix performed every three years for constituents of concern.
Grass covered	Unclear.
Biosludges, 17 MT/day, generated from other chemical production process lines are also applied to this unit. The sodium chlorate process sludge, 0.12 MT/day, comprises ~1% of the total waste managed in the land farm. (The permit indicates brine solids are ~48% of the wastes applied to the landfarm.)	

Landfill Scenarios

Three facilities manage their wastes in municipal Subtitle D landfills and one facility manages its waste in an industrial Subtitle D landfill.

The SPLP results of all four relevant samples were used to evaluate the industrial Subtitle D landfill management scenario. As demonstrated in **Table 3.10**, the SPLP leachate concentration of all constituents of the four samples of this waste category are below their respective HBLs. The industrial landfill scenario therefore was screened out and not assessed further.

The TCLP results of all four relevant samples were used to assess the municipal Subtitle D landfill scenario. In cases where the TCLP detection limit exceeded the HBL, one half (½) of the detection limit was used to further assess the potential presence of those constituents of concern in the waste. The initial risk screening identified four constituents exceeding the drinking water HBLs: lead, manganese, nickel, and zinc. Total arsenic levels were detected in HT-SN-01 at 14.3 mg/kg. In the TCLP results, a response for arsenic of 0.03 mg/L was observed below the laboratory reported detection limit (<0.5 mg/L). Because the response exceeded the HBL, we assessed arsenic.

Because our initial screening analysis identified constituents of concern, we conducted full risk assessment modeling of this waste. For a more complete description of this analysis, see the Risk Assessment Listing Background Document in the docket for this proposed rulemaking.

We modeled all three volumes reported in the §3007 surveys as being sent to municipal Subtitle D landfills. We focused our full risk assessment modeling on the geological regions in the northwestern and southeastern areas of the country because of the locations of the facilities and the landfills currently being used. The constituents we modeled are arsenic, lead, manganese, nickel, and zinc.

Table 3.12 Summary of Process Sludge without Chromium and Lead That Are Managed in Landfill Scenarios

Facility/RIN	Volume (MT/yr)	Landfill Type/Location
Huron Tech/Augusta, GA/RIN1	135	Municipal county landfill in Elgin, SC
Eka/Columbus, MS/RIN6	130	Municipal D landfill in Starkville, MS
Eka/Moses Lake, WA/RIN1	89	Municipal D landfill in Ephrate, WA
Elf Atochem, OR/RIN1	105.2	Industrial D landfill in Hillsboro, OR

Recycling scenario

Eka Chemicals, Columbus, MS facility ships their wastes (RINs 1 and 3, total 1390 MT/yr) to an offsite facility for reuse. The material is added to mined gypsum used to retard the setting of concrete. Two samples of this waste category were collected (EC-SN-01 and EC-SN-02). As described above for the landfill scenario and land treatment scenario and presented in **Table 3.9**, the constituents of concern from a leaching perspective are arsenic and lead. The constituents that exceeded the soil screening levels included: cadmium and zinc. The volume of Eka's two waste residuals compared to the off-site facility's annual cement production is quite small (~0.22%[12]), therefore, the concentrations of the constituents of concern will be much further diluted and encapsulated in the final cement product. **Table 3.13** presents the calculated resultant concentrations of constituents of concern in the cement product.

[12] The percentage was calculated, based on the information Eka provided, using volumes of RINs 1 (790 MT/yr x 85% solid content) + RIN 3 (600 MT/yr x 65% solid content)/the off-site facility's annual cement production (477,000 MT/yr).

Table 3.13 Calculated Resultant Concentrations of Constituents of Concern in the Cement Product

Parameter	EC-SN-01				EC-SN-02				HBL (mg/L)	SSL[1] (mg/kg)
	Total (mg/kg)	Resultant[2] Total Concen-tration in Cement (mg/kg)	TCLP (mg/L)	Resultant Leachabl eConcen-tration in Cement (mg/L)	Total (mg/kg)	Resultant Total Concen-tration in Cement (mg/kg)	TCLP (mg/L)	Resultant Leachabl e Concen-tration in Cement (mg/L)		
Arsenic	<5	<0.01	<0.005	<0.00001	<5	<0.01	<0.00 5	<0.00001	0.0007	5.2
Cadmium	<5	<0.01	<0.05	<0.0001	<5	<0.01	<0.05	<0.0001	0.0078	4.3
Lead	19.3	0.04	0.12 E	0.0003 E	34.9	0.08	0.05 E	0.0001 E	0.015	400*
Zinc	<50	<0.11	<2	<0.004	<50	<0.11	<2	<0.004	4.7	48

[1] SSL: Soil Screening Level based on geometric mean background concentration (mg/kg) in soils in conterminous U.S. Or soil ingestion HBL (marked *).
[2] Resultant concentration = waste concentration x 0.22% (see page 27, footnote 12 for calcuation of the percentage of wastes in the cement product)
E: Analysis performed outside recommended holding time. Reported value should be considered as estimated.

3.3.4 Spent Filters with Chromium or Lead

Waste Generation

Seven facilities reported generating this wastestream. The filters are generated at several points in the production process but most are generated after the electrolysis of the brine solution when the mother liquor is filtered to remove impurities before the mother liquor proceeds through the production process. These filters are generated at various rates from less than 1 MT/yr to 15 MT/yr. Appendix A, Table 3 lists wastestreams of this waste category, including the waste generators, RINs, RCRA waste codes, waste volumes, final waste management step, and record sample numbers.

Waste Management

In general spent filters with chromium or lead are generated in small volumes. Six of the seven facilities manage their spent filters in C landfills or incinerator. One exception, Kerr-McGee, Hamilton, Mississippi facility washes their spent filters with dilute hydrochloric acid prior to landfilling at an industrial D landfill in MS. **Table 3.14** presents the volume and final management step used by the facilities for this wastestream.

Table 3.14 Waste Management Summary for Spent Filters with Chromium or Lead

Final Management	Total Volume (MT/yr)
Off-site Subtitle C landfill	54.7
Incineration	25.9
Off-site industrial Subtitle D landfill	2.3

Waste Characterization

These filters carry hazardous waste codes D001, D007 or D008.
Two sources of residual characterization were developed during the industry study:

- RCRA § 3007 questionnaire
- One record sample was collected from one facility and analyzed by EPA.

This wastestream is a mixture of cellulosic filter aid or polypropylene filter bags and impurities removed from the sodium chlorate solution as it exits the electrolytic cells. Facilities report chemical impurities such as arsenic, aluminum, zinc, calcium carbonate, sodium chloride and magnesium hydroxide. The wastestream is contaminated with hexavalent chromium.

Physical properties reported are pH in the 7 to 8 range and moisture content in the 10% range.

We collected one sample of the spent filter that was decharacterized prior to being sent to an industrial Subtitle D landfill. We did not sample any of the six facilities that already adequately managed the waste under Subtitle C regulations. **Table 3.15** shows the sample of spent filters with chromium or lead collected and its corresponding sample number.

Table 3.15 Record Sample, Filter Wastes with Chromium or Lead

Facility	Sample No.
Kerr-McGee, Hamilton, MS	KM-FB-01

KM-FB-01 is generated as part of the brine treatment step where impurities are filtered from the brine solution.

Table 3.16 presents the analytical results for the total and leaching analyses of the waste sample for arsenic, total and hexavalent chromium, and lead. Full analyses are summarized in Appendix B and in detail in "*Sampling and Analytical Data Report for Record Sampling and Characterization of Wastes from the Inorganic Sodium Chlorate Manufacturing Sector- Kerr-McGee Corporation, Hamilton, Mississippi, August 10, 1999*" in the docket for this proposal.
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Table 3.16 Analytical Results of Sampling Spent Filters with Chromium or Lead Wastestream

Parameter	Total (mg/kg)	TCLP (mg/L)	SPLP (mg/L)	Drinking Water HBLs (mg/L)
Arsenic	<0.5	<0.5	0.005	0.00074
Chromium	41.0	<0.05	<0.05	23
Chromium +6	16.8	NA*	<0.02**	0.05
Lead	<5	<0.5	<0.03	0.015

*NA Not applicable.
** Typical TCLP leachant is not suitable for leachable hexavalent chromium. Most (or all) hexavalent chromium in TCLP waste leachates were converted to trivalent chromium. The leach test for hexavalent chromium was modified by replacing the typical (TCLP/SPLP) leachants with deionized water.

<u>Results of Initial Risk Screening Analysis</u>

Chromium and lead are the two primary constituents of concern in wastes of this category. Kerr McGee does not use anodes with lead coating, thus lead was not present in this sample. The only constituent detected in TCLP/SPLP leachates above the HBL is arsenic. [Note that the total arsenic results were further assessed and no response was found below the revised detection limit of 0.5 mg/kg.]

We did not conduct risk assessment on wastes managed in Subtitle C facilities because listing would not provide any significant incremental control of wastes already managed under Subtitle C. We evaluated the small volume waste (i.e., 2.3 MT/yr) generated by Kerr McGee that decharacterizes its waste before landfilling in an industrial Subtitle D landfill. Because the volume of Kerr McGee's waste is relatively small, we used the de minimis waste quantity analysis to screen the potential risk to groundwater associated with landfilling this waste. We found that the SPLP data for arsenic screens out because the volume of the waste generated by Kerr McGee's Hamilton, MS facility is insufficient to release arsenic at levels of concern. For a more complete description of de minimis waste quantity analysis, see *"Risk Assessment for the Listing Determinations for Inorganic Chemical Manufacturing Wastes" (August 2000)* in the docket for this proposal.

3.3.5 Spent Filters without Chromium and Lead

<u>Waste Generation</u>

Four facilities reported generating this wastestream. This residual is usually generated as part of the initial brine purification steps where impurities are removed from the brine solution. One other source of spent filters without chromium is from the filtering of the Dechrome product during the packaging process. The filters are disposable cartridges, bag filters and sock filters. The generation rate for this residual varies from less than 1 MT/yr to approximately 2 MT/yr. Appendix A, Table 4 lists wastestreams of this waste category, including the waste generators, RINs, RCRA waste codes, waste volumes, final waste management step, and record sample numbers.

<u>Waste Management</u>

This waste is managed in a variety of ways: disposal in municipal and industrial Subtitle D landfills and Subtitle C landfills. **Table 3.17** presents the volume and final management step used by the facilities for this wastestream.

Table 3.17 Waste Management Summary for Spent Filters without Chromium or Lead

Final Management	Total Volume (MT/yr)
Off-site municipal Subtitle D landfill	2.8
Off-site industrial Subtitle D landfill	0.6
Off-site Subtitle C landfill	0.12

Waste Characterization

These filters are reported as nonhazardous waste.
Two sources of residual characterization were developed during the industry study:

- RCRA § 3007 questionnaire

  Physical properties reported were pH of 10 and moisture content of 2% -85%. Chemical constituents reported are calcium carbonate, magnesium hydroxide, arsenic, aluminum, titanium and lead.

- Two record samples were collected from one facility and analyzed by EPA.

Two samples were taken at Huron Tech- Augusta, GA facility. **Table 3.18** shows the filter wastes without chromium samples collected and the sample numbers.

Table 3.18 Record Samples, Filter Wastes without Chromium or Lead

Facility	Sample No.
Huron Tech, Augusta, GA	HT-FB-01 HT-FB-02

HT-FB-01 is a combination of two filter bags generated at different points in the process: after the initial purification step in the brine treatment process and after the sodium chlorate redissolve step where the crystals are dissolved in water and then filtered. HT-FB-02 are the solids that are filtered from the sodium chlorate product after it comes from the crystallizers and is redissolved in pure water.

Results of Initial Risk Screening Analysis

Table 3.19 presents the constituents detected or not detected the TCLP or SPLP waste leachates at levels above their HBLs.

Table 3.19 Analytical Results of Sampling Spent Filters without Chromium or Lead Wastestream

Analytical Results for Spent Filters Without Chromium or Lead							
Parameter	HT-FB-01			HT-FB-02			HBL (mg/l)
	Total (mg/kg)	TCLP (mg/l)	SPLP (mg/l)	Total (mg/kg)	TCLP (mg/l)	SPLP (mg/l)	
Antimony	34.1	0.018	<0.005	<5	0.012	<0.005	0.006
Arsenic	7.3	0.014	0.003	5.3	<0.005	<0.005	0.0007
Boron	<50	6.1	<0.05	<50	0.67	<0.5	1.4
Cadmium	22.5	<0.05	<0.05	<5	<0.05	<0.05	0.008
Cr, +6	<0.8	NA	<0.02	2.8 L	NA	0.19 L	0.05
Lead	8.7	0.024	0.06	7.1	0.020	0.012	0.015

L: Concentration reported from analysis performed outside required holding time. Value should be considered biased low.

We found that antimony, arsenic, boron, hexavalent chromium, and lead in the TCLP or SPLP waste leachates exceeded their HBLs. We also found that cadmium was not detected in the leachates at a detection level of six times higher than its HBL due to dilution to minimize sample matrix interferences.

The scenarios of concern are the municipal and industrial landfill scenarios, based on reported management practices. These wastes are generated in very small volumes; the highest individual volume is 2.3 MT/yr and the total volume for the industry is 3.52 MT/yr.

We used the SPLP leachate concentrations to evaluate the industrial landfill scenario. The constituents of concern that exceeded their respective HBLs in the SPLP results were arsenic, hexavalent chromium, and lead. We evaluated these constituents using the de minimis volume screening analysis. The analysis suggests that hexavalent chromium and lead are not of concern. We then modeled arsenic using our standard groundwater model for the industrial landfill scenario using waste volume 0.6 MT/year.

We used the TCLP leachate concentrations to evaluate the municipal landfill scenario. Using the de minimis volume analysis, we screened out boron, hexavalent chromium, and lead. We then conducted full groundwater modeling for the municipal scenario for antimony, arsenic, and cadmium. The modeling of the municipal landfill scenario used the TCLP results as input for antimony, arsenic, and cadmium and waste volume of 2.8 MT/year.

Table 3.20 Summary of Spent Filters without Chromium and Lead That Are Managed in Landfills

Facility/RIN	Volume (MT/yr)	Landfill Name/Location
Huron Tech- Augusta/RINs2+6	2.3	Municipal county D landfill in Blythe, GA.
Eka/Moses Lake, WA/RIN2	0.5	Municipal D landfill in Ephrata, WA
442 Corp- Perdue Hill /RINs1+2	0.6	Off-site industrial D landfill owned by Alabama River Pulp, Perdue Hill, AL.

For a more complete description of de minimis waste quantity analysis, see *"Risk Assessment for the Listing Determinations for Inorganic Chemical Manufacturing Wastes" (August 2000)* in the docket for this proposal.

3.3.6 Wastewaters with Chromium that are not Recycled Back to the Process

<u>Waste Generation</u>

Two facilities reported generating this wastestream. Eka Chemicals- Colombus, MS facility generates 11 MT per year of this wastewater from its on-site laboratory testings of the electrolyte in the electrolytic cells, the excess caustic from the hydrogen purification step, and the wastewater from the production of sodium chlorate crystals. Kerr McGee- Hamilton, MS facility generates 26,725 MT per year of this wastewater from acid washing filters and anodes to remove buildup of trace metals on the surface. Appendix A, Table 5 lists wastestreams of this waste category, including the waste generators, RINs, RCRA waste codes, waste volumes, final waste management step, and record sample numbers.

<u>Waste Management</u>

Eka stores its wastewater onsite in closed tanks before sending it off-site to a hazardous waste facility for treatment and disposal. Kerr-McGee combines the wastewaters with the wastewaters from its titanium dioxide production process and treats the commingled wastewaters in tanks. The treated wastewater is then discharged to on-site surface impoundments. **Table 3.21** presents the volume and final management step used by the two facilities for this wastestream.

Table 3.21 Waste Management Summary for Wastewaters with Chromium that are not Recycled Back to Process

Final Management	Total Volume (MT/yr)
Physical and chemical treatment	11
Discharge to on-site wastewater treatment facility	26,725

Waste Characterization

Both Eka and Kerr McGee facilities characterize the wastewaters as hazardous (D002, D007) in their RCRA §3007 questionnaires. Other chemical constituents present in this wastestream are aluminum, iron, and phosphorus.

Results of Initial Risk Screening Analysis

Both Eka and Kerr McGee facilities manage their wastewaters in tanks; the impervious nature of the construction materials (concrete, fiberglass, or steel) of tanks is unlikely to result in releases to groundwater. We are unlikely to find potential air releases from these tanks as neither volatile contaminants nor airborne particulates are likely to be present in these aqueous wastes. Because Eka already manages its wastewater in accordance with the Subtitle C regulations, we did not evaluate its waste further. For the Kerr McGee facility, we evaluated its untreated and treated wastes in the waste category of "process sludge with chromium or lead" of this sector. Please see Section 3.3.2 for the assessment.

3.3.7 Other Wastewaters That Do Not Contain Chromium or Lead And Are Not Recycled

Waste Generation

These wastewaters are generated from several points in the process, including process condensate, cooling waters, and ion-exchange wastewater. Four facilities reported generating this wastestream. The Elf Atochem- Portland, OR and George Gulf- Pleaquemine, LA facilities generate process condensates from condensing water vapor from their crystallizers, steam jets, or pad water evaporator. The Huron Tech- Augusta, GA facility generates wastewater from the regeneration of the ion-exchange unit that is used for purification of the brine. The CXY Chemicals-Hahnville, LA facility generates wastewater from cooling tower blowdown, chemical storage tank scrubber pad, hydrogen scrubber pad, and water demineralization area. Appendix A, Table 6 lists wastestreams of this waste category, including the waste generators, RINs, RCRA waste codes, waste volumes, final waste management step, and record sample numbers.

Two facilities (Elf Atochem and George Gulf) reported wastewater generation about 5,000 MT/yr. Other two facilities (CXY and Huron Tech) did not report volumes of their wastewater generations.

Waste Management

The Elf Atochem and George Gulf facilities store their process condensates in closed tanks. Elf Atochem neutralizes their condensate prior to discharging it to an NPDES permitted outfall. George Gulf does not treat their condensate, but tests to ensure it meets the Louisiana State Pollutant Discharge Elimination System permit prior to discharge to a river. Huron Tech generates wastewater from regeneration of the ion-exchange unit that is used for purification of the brine. The wastewater is collected in a tank for pH neutralization before it is discharged to a POTW. CXY generates wastewater from cooling tower blowdown, chemical storage tank scrubber pad, hydrogen scrubber pad, and water demineralization area. These wastewaters are piped to its on-site NPDES facility to be processed and discharged. **Table 3.22** presents the volume and final management step used by the facilities for this wastestream.

Table 3.22 Waste Management Summary for Other Wastewaters That Do not Contain Chromium or Lead and are not Recycled

Final Management	Total Volume (MT/yr)
Discharge to NPDES permitted outfall	10,744
Discharge to POTW	Not reported

Waste Characterization

These wastewaters are reported to have an approximate pH of 7.

Results of Initial Risk Screening Analysis

We evaluated these wastewaters that are stored and treated in tanks or in a NPDES permitted facility. We found that these wastewaters do not pose risks warranting regulation during treatment because there are no exposure pathways of concern. The wastewater treatment tanks and the wastewater treatment facility provide sufficient structural integrity and have secondary containment areas to minimize potential releases to groundwater. We are unlikely to find potential air releases from these tanks or the permitted facility as neither volatile contaminants nor airborne particulates are likely to be present in these wastewaters. Finally, these wastewaters are subject to regulation under the Clean Water Act (CWA) program or a state program. No additional risk assessment was done for this wastestream.

Appendix A

Summary of Waste Generation and Management

Table 1 - Process sludge with chromium or lead					
Facility	**RIN**	**RCRA Waste Code**	**Waste Volume (MT/yr)**	**Final Waste Management Step**	**Sample No.**
CXY Chemicals Hahnville, LA	1	D007	486.8	Off-site Subtitle C landfill	
Eka Chemicals Columbus, MS	5	None Reporte d	46	Off-site Subtitle C landfill	EC-SC-01
Eka Chemicals Moses Lake, WA	4	D007	18	Off-site Subtitle C landfill	
Elf Atochem North America, Inc Portland, OR	4	None Reporte d	.27	Off-site Subtitle C landfill	
Georgia Gulf Corp. Plaquemine, LA	2	D007	365	Off-site Subtitle C landfill	
Georgia Gulf Corp. Plaquemine, LA	5	D007	10	Off-site Subtitle C landfill	
Huron Tech Corp. Augusta, GA	3	D001 D007	43	Off-site hazardous waste incineration	HT-SC-01
Huron Tech Corp. Augusta, GA	4	D001 D007	3.6	Off-site hazardous waste incineration	HT-SC-01
Huron Tech Corp. Augusta, GA	5	D001 D007	18.2	Off-site hazardous waste incineration	HT-SC-02
Kerr-McGee Chemical LLC Hamilton, MS	1	D007	6000	Discharge to on-site wastewater treatment facility	

Table 1 - Process sludge with chromium or lead					
Facility	**RIN**	**RCRA Waste Code**	**Waste Volume (MT/yr)**	**Final Waste Management Step**	**Sample No.**
Kerr-McGee Chemical LLC Hamilton, MS	2	D007	5300	Discharge to on-site wastewater treatment facility	
Kerr-McGee Chemical LLC Hamilton, MS	5	D007	500	Discharge to on-site wastewater treatment facility	
Kerr-McGee Chemical LLC Hamilton, MS	8	D007	4000	Discharge to on-site wastewater treatment facility	
Kerr-McGee Chemical LLC Hamilton, MS	9	D007	11000	Discharge to on-site wastewater treatment facility	
442 Corporation Perdue Hill, AL	3	D007	1.4	Off-site Subtitle C landfill	
Sterling Pulp Chemicals Valdosta, GA	1	D001	630*	Off-site Subtitle C landfill	
Sterling Pulp Chemicals Valdosta, GA	2	None Reported	NR	Off-site Subtitle C landfill	
Sterling Pulp Chemicals Valdosta, GA	3	None Reported	NR	Off-site Subtitle C landfill	
Western Electrochemical Cedar City, UT	4	D001 D008	125	Off-site Subtitle C landfill	

* The total volume include RINs 2 and 3. Total 28,547 MT/yr

Table 2 - Process sludge without chromium and lead					
Facility	**RIN**	**RCRA Waste Code**	**Waste Volume (MT/yr)**	**Final Waste Management Step**	**Sample No.**
Eka Chemicals Columbus, MS	1	None Reported	790	Recycling	EC-SN-01
Eka Chemicals Columbus, MS	6	None Reported	130	Off-site municipal Subtitle D landfill	EC-SN-03
Eka Chemicals Columbus, MS	3	None Reported	600	Off-site municipal Subtitle D landfill	EC-SN-02
Eka Chemicals Moses Lake, WA	1	None Reported	89	Off-site municipal Subtitle D landfill	
Elf Atochem North America, Inc Portland, OR	1	None Reported	105.2	Off-site industrial Subtitle D landfill	
Georgia Gulf Corp. Plaquemine, LA	1	None Reported	37	Permitted solid waste landfarm	
Huron Tech Corp. Augusta, GA	1	None reported	135	Off-site municipal Subtitle D landfill	HT-SN-01

Total 1,886.2 MT/yr

Table 3 - Spent filters with chromium or lead					
Facility	**RIN**	**RCRA Waste Code**	**Waste Volume (MT/yr)**	**Final Waste Management Step**	**Sample No.**
CXY Chemicals Hahnville, LA	2,2A-2E	D007	50	Off-site Subtitle C landfill	
Eka Chemicals Moses Lake, WA	3	D007	0.5	Off-site hazardous waste incineration	
Georgia Gulf Corp. Plaquemine, LA	3	D007	1	Off-site Subtitle C landfill	
Huron Tech Corp. Augusta, GA	7	D001 D007	6.8	Off-site hazardous waste incineration	
Huron Tech Corp. Augusta, GA	8	D001 D007	3.6	Off-site hazardous waste incineration	
Huron Tech Corp. Augusta, GA	9	D001 D007	15	Off-site hazardous waste incineration	
Kerr-McGee Hamilton, MS	3	None Reported	2.3	Off-site Subtitle D landfill	KM-FB-01
442 Corporation Perdue Hill, Al	4	D007	.3	Off-site Subtitle C landfill	

Facility	**RIN**	**RCRA Waste Code**	**Waste Volume (MT/yr)**	**Final Waste Management Step**	**Sample No.**
442 Corporation Perdue Hill, Al	5	D007	.3	Off-site Subtitle C landfill	
442 Corporation Perdue Hill, Al	6	D007	.1	Off-site Subtitle C landfill	
Western Electrochemical Company Cedar City, UT	1	D008	1	Off-site Subtitle C landfill	
Western Electrochemical Company Cedar City, UT	2	D008	2	Off-site Subtitle C landfill	

Total 82.9 MT/yr

Table 4 - Spent filters without chromium and lead					
Facility	**RIN**	**RCRA Waste Code**	**Waste Volume (MT/yr)**	**Final Waste Management Step**	**Sample No.**
Eka Chemicals Moses Lake, WA	2	None Reported	0.5	Off-site municipal Subtitle D landfill	
Huron Tech Corp. Augusta, GA	2	None Reported	0.9	Off-site municipal Subtitle D landfill	HT-FB-01
Huron Tech Corp. Augusta, GA	6	None reported	1.4	Off-site municipal Subtitle D landfill	HT-FB-02
442 Corporation Perdue Hill, Al	1	None reported	0.3	Off-site industrial Subtitle d landfill	
442 Corporation Perdue Hill, Al	2	None reported	0.3	Off-site industrial Subtitle D landfill	
Sterling Pulp Chemicals Inc. Valdosta, GA	4	None reported	0.12	Off-site Subtitle C landfill	

Total 3.52 MT/yr

Table 5 - Wastewaters with chromium that are not recycled back to process					
Facility	**RIN**	**RCRA Waste Code**	**Waste Volume (MT/yr)**	**Final Waste Management Step**	**Sample[1] No.**
Eka Chemicals Columbus, MS	4	D002 D007	11	Off-site hazardous waste treatment facility	
Kerr-McGee Hamilton, MS	1	D007	6000	On-site wastewater treatment facility	
Kerr-McGee Hamilton, MS	4	D002 D007	200	On-site wastewater treatment facility	
Kerr-McGee Hamilton, MS	6	D002 D007	525	On-site wastewater treatment facility	
Kerr-McGee Hamilton, MS	10	D007	20000	On-site wastewater treatment facility	

Total 26,736 MT/yr

[1] KM-SC01: sampled at a dedicated sump (waters from sodium chlorate process, combined RINs)

Table 6 - Other wastewaters that do not contain chromium or lead and are not recycled					
Facility	**RIN**	**RCRA Waste Code**	**Waste Volume (MT/yr)**	**Final Waste Management Step**	**Sample No.**
CXY Chemicals Hahnville, LA	Not assigned	None Reported	Not Reported	POTW	
Elf Atochem Portland, OR	3	None Reported	4879	NPDES permitted outfall	
Georgia Gulf Plaquemine, LA	4	None Reported	5865	Louisiana State PDES permitted outfall	
Huron Tech Augusta, GA	Not assigned	None Reported	Not Reported	POTW	

Appendix B

Record Sampling Analytical Data Reports